Improvement of STAR TPC Tracking

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STAR is a multi-purpose RHIC detector which is designed to cover many physics aspects of relativistic heavy ion collisions including strangeness production, high p_t particles, collective flow, and HBT. Accurate measurement of charged particles are an essential part of these physics, and TPC is one of the most important subdetectors for year-1 physics at STAR. It is no surprise that most of the attention has been focused on the performance of TPC simulation and reconstruction software. Among all the TPC softwares, the tracking package is the most critical. The current STAR TPC tracking package (tpt) will be quite sufficient for most of the year-1 studies. However, each tracking algorithm has its own limitation, and tpt is no exception. These limitations have already manifested in the cosmic ray and laser data taken in June 1999. Since these tracks are similar to the non-primary vertex tracks in nucleus-nucleus collisions, so the current limitations of tpt could affect the ability of STAR to study physics of the strangeness production.

In constructing a track, tpt assumes all tracks originates from the primary vertex position ((0,0,0) is used). This is the main reason for the reduced efficiency of the secondary track reconstruction. In the E910 tracking algorithm, one relies on the hit clusters to build tracks, and there is no need to assume the position of the production vertex, thus avoids the bias problem. Using dynamic fitting, it turns out this tracking algorithm also improves the tracking accuracy for all tracks including the primary tracks.

An important factor in our successfully adoptation of the E910 tracking method is that the basic parameters of STAR TPC and E910 TPC are very similar, although there are many other differences on the hardwares. After six months of intensive effort, we have created a working package called StTpt based on the E910 tracking codes. Even at this early stage, StTpt already has the same functionalities of tpt.

About 1500 cosmic events taken on December 1999 have been analyzed with both StTpt and tpt. Comparison of the number of hits on tracks (Fig.1) shows that there are more long (good) tracks reconstructed by StTpt than by tpt. Analysis on the laser data reveals a similar improvement.

The new tracking codes also ported tpt from Fortran to C++. The development of StTpt is still in a very early stage. There are plenty of rooms for improvement. For example it is not yet capable of dealing with tracks which only pass through the inner sectors because of the special structure of STAR TPC.

This work has also facilitated the progress of tpt by identifying possible areas of improvement, and offering some concrete solutions to the existing problems.

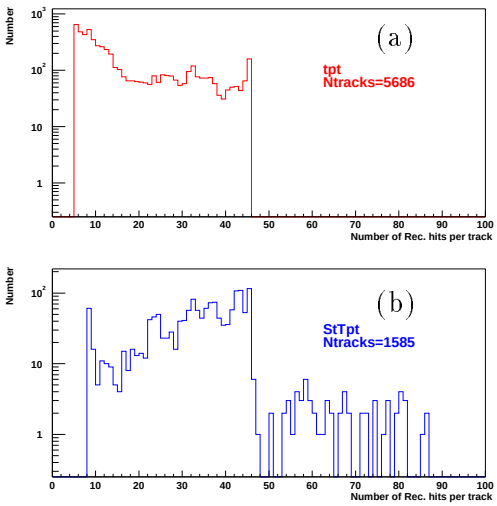

Figure 1: *Number of hits on the reconstructed tracks for 1500 cosmic events (a) reconstructed with tpt; (b) reconstructed with StTpt.*